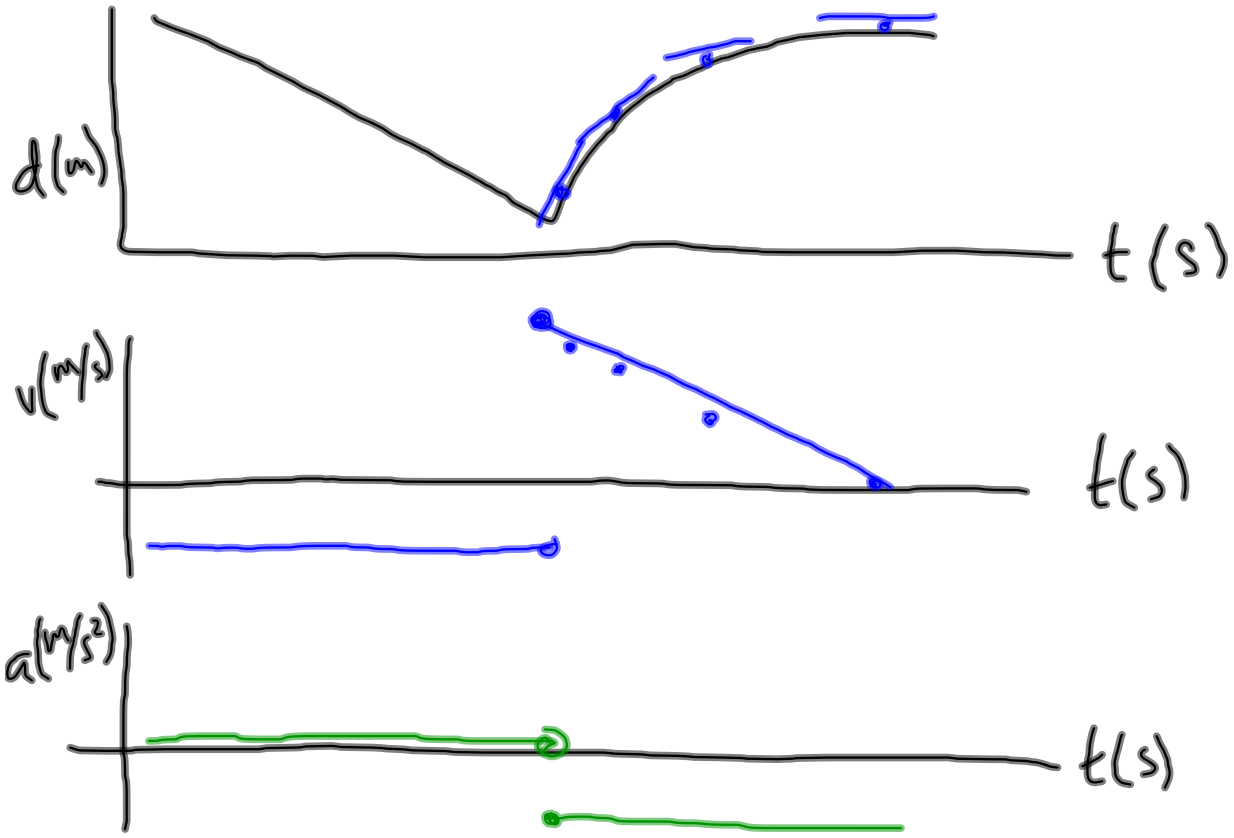
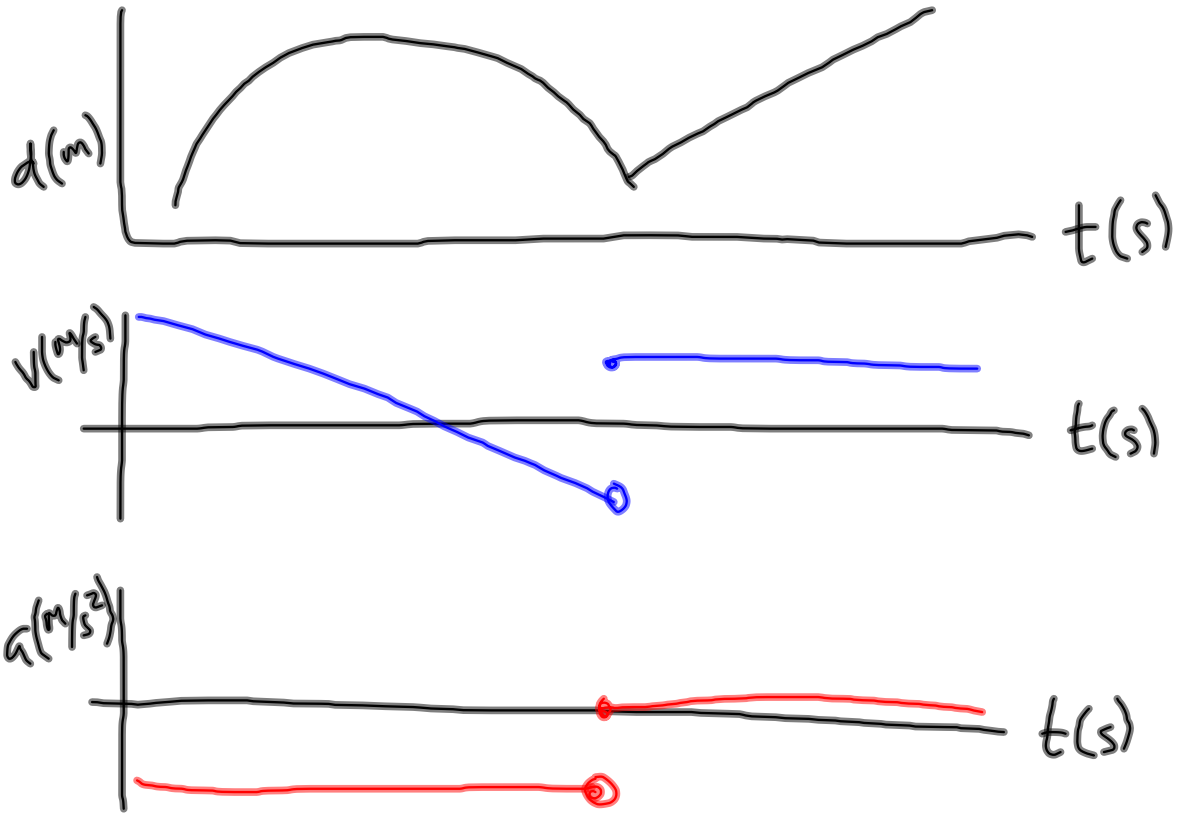
Kinematics Equations and Practice Problems 1.30.12 Honors Physics




d(m)
t(s)
v(m/s)
t(s)
a(m/s²)
t(s)

Velocity	Acceleration	Motion of object
+	+	speed up
−	−	speed up
+	−	slow down
−	+	slow down
− or +	∅	constant velocity
∅ (initial)	− or +	speeding up from rest
∅	∅	not moving

Kinematics Equations:

$V_i \rightarrow$ initial velocity

$V_f \rightarrow$ final velocity

$a \rightarrow$ acceleration

$t \rightarrow$ time

$\Delta x \rightarrow$ displacement

$$\Delta x = V_i t + \frac{1}{2} a t^2$$

$$V_f = V_i + at$$

$$V_f^2 = V_i^2 + 2a\Delta x$$

A car is traveling on the highway at 35 m/s when he sees the light ahead of him turn red. If it takes him 4.35 s to stop in 582 m, what was his acceleration?

$35\ m/s \rightarrow v_i$ $582\ m \rightarrow \Delta x$

$4.35\ s \rightarrow t$ $a \rightarrow ?$

comes to a stop $\rightarrow 0\ m/s \rightarrow v_f$

$$v_f = v_i + at$$

$$a = \frac{v_f - v_i}{t}$$

$$= \frac{0\ m/s - 35\ m/s}{4.35\ s}$$

$$= -8.04\ m/s^2$$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$\frac{1}{2} a t^2 = \Delta x - v_i t$$

$$a = \frac{2(\Delta x - v_i t)}{t^2}$$

A plane starting at rest at one end of a runway undergoes a uniform acceleration of 4.8 m/s/s for 15 s before takeoff.
a) What is its speed at takeoff?
b) How long must the runway be for the plane to be able to take off?

$v_i = 0\ m/s \qquad t = 15\ s \qquad \Delta x = ?$

$a = 4.8\ m/s^2 \qquad v_f = ?$

a) $v_f = v_i + at$

$= 0\ m/s + (4.8\ m/s^2)(15\ s)$

$= 72\ m/s$

b) $\Delta x = \cancel{v_i t} + \frac{1}{2}at^2$

$= \frac{1}{2}(4.8\ m/s^2)(15\ s^2)$

$= 540\ m$

A car accelerates uniformly in a straight line from rest at the rate of 2.3 m/s/s.
a) What is the speed of the car after it has traveled 55 m?
b) How long does it take the car to travel 55 m?

$V_i = 0\ m/s \qquad a = 2.3\ m/s^2$

a) $\Delta x = 55\ m \qquad V_f = ?$

$$V_f^2 = V_i^2 + 2a\Delta x$$

$$V_f = \sqrt{2a\Delta x}$$

$$= \sqrt{2(2.3\ m/s^2)(55\ m)}$$

$$= 15.9\ m/s$$

b) $$V_f = V_i + at$$

$$t = \frac{V_f - V_i}{a}$$

$$= \frac{15.9\ m/s - 0\ m/s}{2.3\ m/s^2}$$

$$= 6.92\ s$$

Test Friday

HW: p. 55: 1, 3

p. 58: 4, 5

Walking Activity:

- 1 paper per group
- Measure t (everyone times) and Δx
- Must start at rest or finish at rest
- Calculate acceleration
- 2x per person